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TCSS422: Intro to Operating Systems
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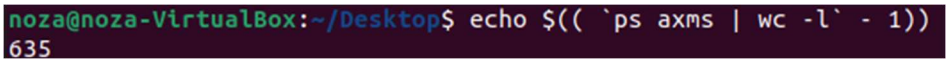
Quiz 1

1. How many total **processes** are running (i.e., including all in different states like waiting) shortly after the Ubuntu VM boots up?

    1. `ps -e | wc -l`
    2. 

    3. Process Status - `ps` command - is used to list running processes in Linux. It displays the currently running processes in real-time. Total processes running on my VM is **197**.

2. How many total **threads** are running (i.e., including all in different states like waiting) shortly after the Ubuntu VM boots up?
    1. `echo $(( `ps axms | wc -l` - 1))`
    2. 

    3. The command above shows the total number of threads running, which is **635**.

3. What is the **version number of the Linux kernel** installed on your Ubuntu VM?

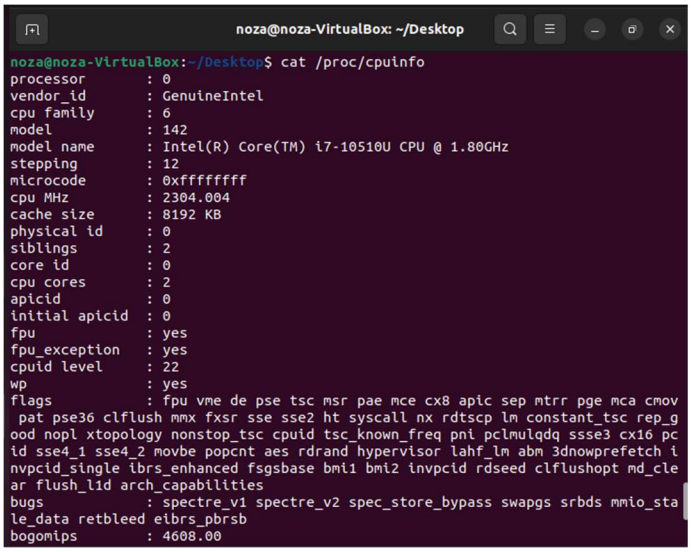
    1. `uname -r`
    2. 

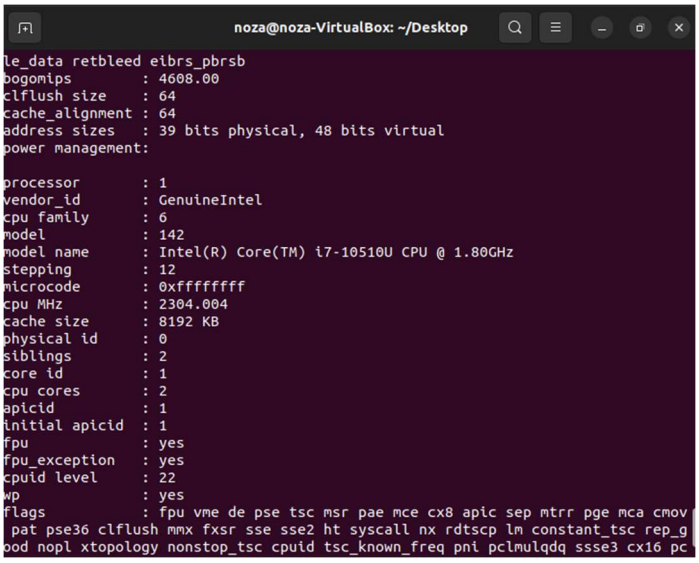
    3. `uname` command is used to print out certain system information, which includes kernel name. From the above screenshot, my Linux kernel version is **`5.12.9-56`**, where:
    `5` – Kernel version
    `12` – Major revision
    `9` – Minor revision
    `56` – Patch lever/number
    `generic` – Linux kernel/distro specific additional information

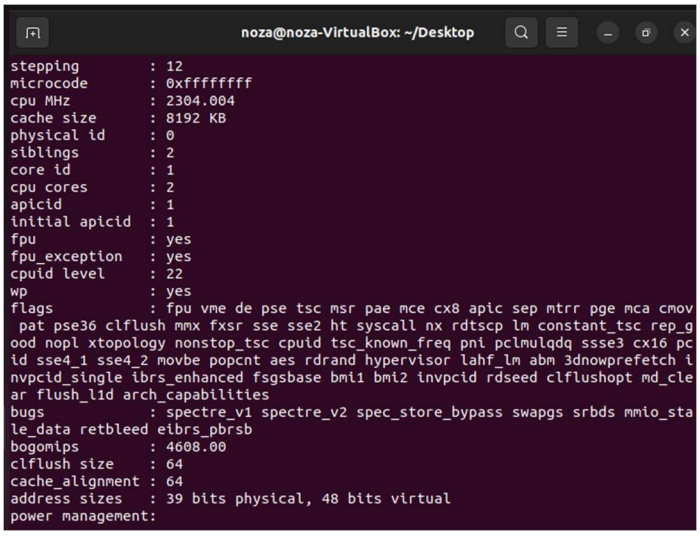
4. What is the model name of the CPU(s) of the VM? According to wikipedia or Intel/AMD specification pages, how many CPU cores does this CPU have? If the information is available, what was the release date of the CPU, and the original retail price?

    1. `cat /proc/cpuinfo`

2.

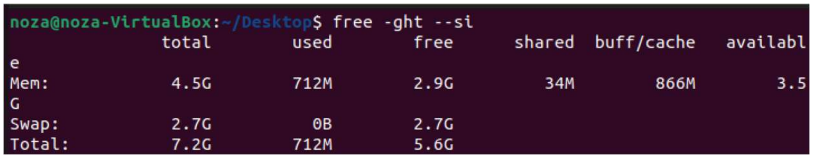

noza@noza-VirtualBox: ~/Desktop
noza@noza-VirtualBox:~/Desktop$ cat /proc/cpuinfo
processor : 0
vendor_id : GenuineIntel
cpu family : 6
model : 142
model name : Intel(R) Core(TM) i7-10510U CPU @ 1.80GHz
stepping : 12
microcode : 0xffffffff
cpu MHz : 2304.004
cache size : 8192 KB
physical id : 0
siblings : 2
core id : 0
cpu cores : 2
apicid : 0
initial apicid : 0
fpu : yes
fpu_exception : yes
cpuid level : 22
wp : yes
flags : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
pat pse36 clflush mmx fxsr sse sse2 ht syscall nx rdtscp lm constant_tsc rep_g
ood nopl xtopology nonstop_tsc cpuid tsc_known_freq pni pclmulqdq ssse3 cx16 pc
id sse4_1 sse4_2 movbe popcnt aes rdrand hypervisor lahf_lm abm 3dnowprefetch i
nvpcid_single ibrs_enhanced fsgsbase bmi1 bmi2 invpcid rdseed clflushopt md_cle
ar flush_l1d arch_capabilities
bugs : spectre_v1 spectre_v2 spec_store_bypass swapgs srbds mmio_sta
le_data retbleed eibrs_pbrsb
bogomips : 4608.00


noza@noza-VirtualBox: ~/Desktop
le_data retbleed eibrs_pbrsb
bogomips : 4608.00
clflush size : 64
cache_alignment : 64
address sizes : 39 bits physical, 48 bits virtual
power management:
processor : 1
vendor_id : GenuineIntel
cpu family : 6
model : 142
model name : Intel(R) Core(TM) i7-10510U CPU @ 1.80GHz
stepping : 12
microcode : 0xffffffff
cpu MHz : 2304.004
cache size : 8192 KB
physical id : 0
siblings : 2
core id : 1
cpu cores : 2
apicid : 1
initial apicid : 1
fpu : yes
fpu_exception : yes
cpuid level : 22
wp : yes
flags : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
pat pse36 clflush mmx fxsr sse sse2 ht syscall nx rdtscp lm constant_tsc rep_g
ood nopl xtopology nonstop_tsc cpuid tsc_known_freq pni pclmulqdq ssse3 cx16 pc


noza@noza-VirtualBox: ~/Desktop
stepping : 12
microcode : 0xffffffff
cpu MHz : 2304.004
cache size : 8192 KB
physical id : 0
siblings : 2
core id : 1
cpu cores : 2
apicid : 1
initial apicid : 1
fpu : yes
fpu_exception : yes
cpuid level : 22
wp : yes
flags : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
pat pse36 clflush mmx fxsr sse sse2 ht syscall nx rdtscp lm constant_tsc rep_g
ood nopl xtopology nonstop_tsc cpuid tsc_known_freq pni pclmulqdq ssse3 cx16 pc
id sse4_1 sse4_2 movbe popcnt aes rdrand hypervisor lahf_lm abm 3dnowprefetch i
nvpcid_single ibrs_enhanced fsgsbase bmi1 bmi2 invpcid rdseed clflushopt md_cle
ar flush_l1d arch_capabilities
bugs : spectre_v1 spectre_v2 spec_store_bypass swapgs srbds mmio_sta
le_data retbleed eibrs_pbrsb
bogomips : 4608.00
clflush size : 64
cache_alignment : 64
address sizes : 39 bits physical, 48 bits virtual
power management:

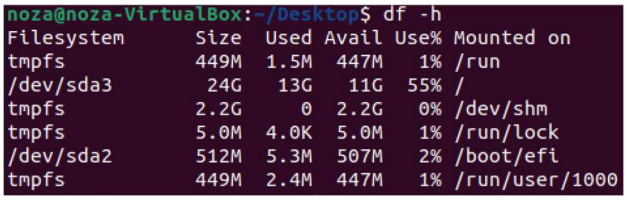
3. /`proc/cpuinfo` display what type of processor the system is running, which includes the number of CPUs present. The output would show the details of the processor, CPU family, model name, CPU MHz, cache size, flags, etc. On my VM, the model names of the CPU 0 and CPU 1 are the same: **Intel(R) Core(TM) i7-10510U CPU @ 1.80GHz.** According to Intel specifications pages, these processors have **2** CPU cores and their recommended retail price is **450.00** USD.

5. What is the total size of the memory **swap space** (virtual memory) in **MB** on the VM?

    1. `free -ght --si`
    2. 

    3. free command gives information about the memory usage and memory swap of the system. On my VM, the total swapped is **2700** MB.

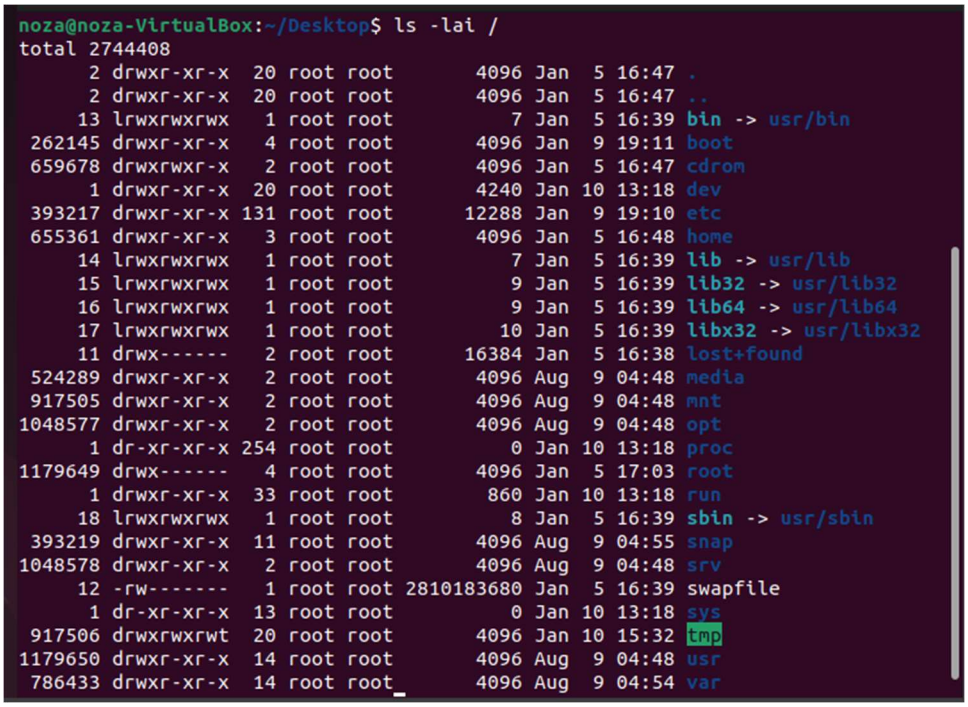
6. What is the free disk space of the root disk partition in MB? In Linux, the root partition is always mounted at "/". A mount point is the directory or location in the file system where an I/O device has been mounted. The mount point is used to access the device through a file system.

    1. `df -h`
    2. 

    3. `df` command (Disk Filesystem) is used to check disk space, it displays the available and used storage of the files on the machine. `-h` flag is used to display the result in t a human readable format. Hence, the free disk space of the root disk partition is **11000** MB.

7. What is the total number of inodes on the root filesystem? If unfamiliar with what an inode is, look up the definition and how to display the number of free/used inodes on Linux/Ubuntu.

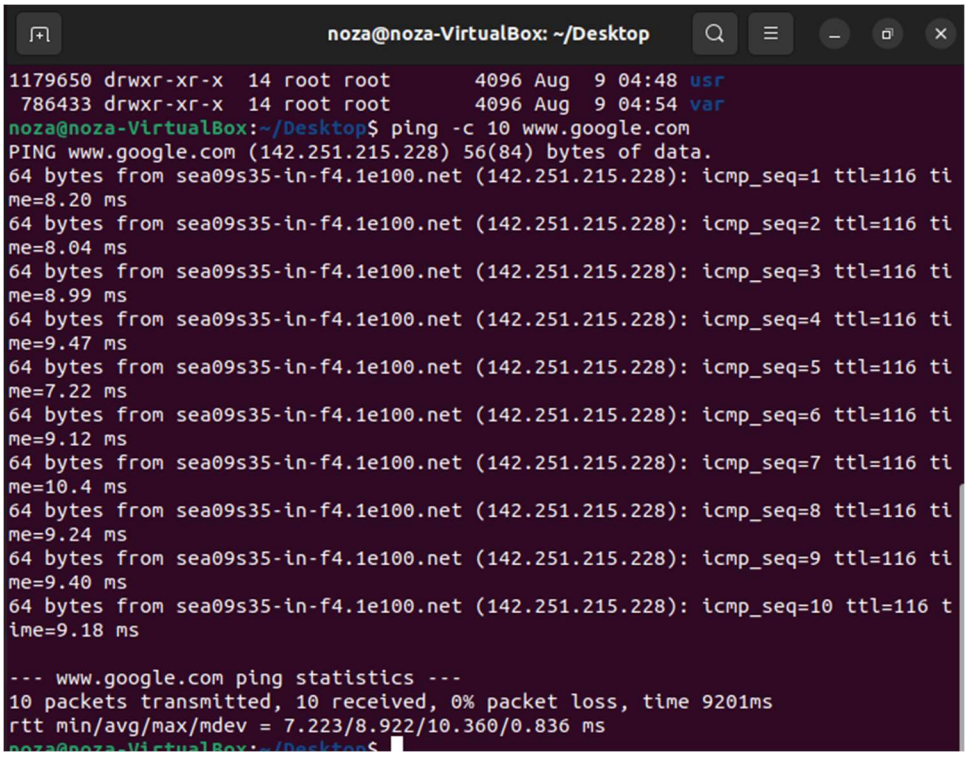
    1. `ls -lai /`

2. 

3. I ran `ls` command, where the `-l` option stands for long listing format, `-a` stands for all files, and `-i` stands for print the index number of each file. Hence, the total number of inodes on the root filesystem is **2744408**.

8. What is the average round trip time (RTT) of 10 ICMP ping packets from your Ubuntu VM to [www.google.com Links to an external site.](www.google.com)?

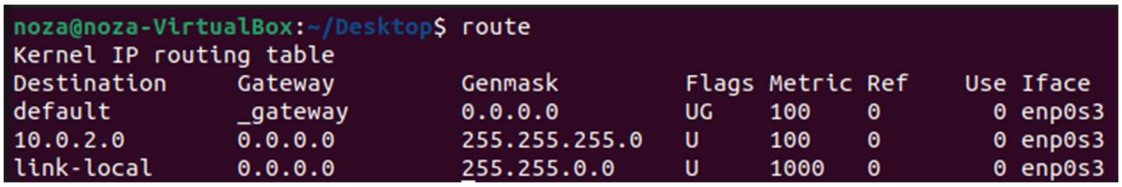
    1. `ping -c 10 www.google.com`

2. 

3. `-c` flag is used to specify the number of ECHO_REQUEST's to be sent following each ping, in this question it's 10. As the last line of output shows, the average `RTT` of 10 ICMP ping packets is **`8.922`**.

9. What is the interface name of the network interface device used to route the ICMP ping packets to www.google.com Links to an external site.?

    1. `route`

    2. 

    3. `route` interface is used to access the kernel's routing tables, which shows how the system is currently configured. Hence, the interface name of the network interface device used to route is **`enp0s3`**.

10. Identify the file system type of the "/" root partition? Briefly describe this file system type (1-2 sentences).

    1. `df -Th`

2.
```
noza@noza-VirtualBox:~/Desktop$ df -Th
Filesystem     Type   Size  Used Avail Use% Mounted on
tmpfs          tmpfs  449M  1.5M  447M   1% /run
/dev/sda3      ext4    24G   13G   11G  55% /
tmpfs          tmpfs  2.2G     0  2.2G   0% /dev/shm
tmpfs          tmpfs  5.0M  4.0K  5.0M   1% /run/lock
/dev/sda2      vfat   512M  5.3M  507M   2% /boot/efi
tmpfs          tmpfs  449M  2.4M  447M   1% /run/user/1000
```

3. /dev/sda3 file system type is **ext4** and /dev/sda2 file system type is **vfat**. ext4 file system type is a journaling file system, which means there are no fragmentation issues and the read/write are significantly faster with Ext. vfat file system type has maximum of 4 GB file-size.